The Use and Economic Impacts of ICT at the Macro-Micro levels in the Arab Gulf Countries

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Abstract

In this paper we use some primary micro data from the firm survey of Nour (2002b) and some secondary cross countries data to examine four stylised facts on the use and economic impacts of ICT at both macro-micro levels in the Arab Gulf countries. We find that at the macro and micro levels the demand for ICT (measured by the use and spending on ICT) is characterizing by considerable dynamism over time, i.e. shows a dynamic increasing trend across countries, but an opposite decreasing trend across firms. At the macro level the use/demand for ICT shows a normal demand curve decreasing in price and increasing in income (measured by GDP per capita). Our results are consistent with the conventional view on the relationship between demand and income, i.e. a high population access to Internet, telephone and mobile is corresponding to a high GDP per capita. We find that the use of Internet is consistent with the conventional downward sloping demand curve in price, i.e. a fall in the price of Internet service is corresponding to a more population access to Internet. Different from the conventional downward sloping demand curve in price, somewhat surprising the use of telephone show upward sloping demand curve in price, i.e. a rise in the price of telephone service is correlated with a more population use of telephone. At the micro level, total spending on ICT increases in firm size (capital and labour) and industry level. At the macro level, the use of Internet and mobile shows positive significant correlations (complementary relationships) with the use of telephone. At the micro level, the use/total spending on IT (computer) shows positive significant correlations (complementary relationships) with both telecommunication and ICT training. At the micro level, we find positive correlations between the total spending on ICT, output and profit. At the macro level, spending on ICT as percentage to GDP shows a positive significant correlation with GDP- as indicator of economic growth- and a positive insignificant correlation with schooling. Therefore, the total spending on ICT shows positive but somewhat inconclusive economic impacts at both micro and macro levels in the Gulf countries.

Keywords: The use of ICT, ICT market, ICT impacts, Gulf countries.
JEL classification: O0, O3

Introduction

In the recent years the diffusion of information and communication technologies (ICT) and the influences they create on economic systems increased rapidly in both the developed and developing countries.

In this paper we examine the use and economic impacts of ICT at the macro-micro levels mainly in the Arab Gulf countries. Our paper is organized as follows: Section 1 presents an introduction and briefly shows the theoretical and empirical literature on the effect of ICT and the relationship between ICT and economic growth as confirmed in the endogenous growth literature. Next we examine the first and second stylised facts on the status, nature, trend and determinants of the use and demand for ICT at the macro-micro levels in the Arab Gulf countries in Section 2. Section 3 discusses the third and fourth stylised facts on the economic impacts of the use of ICT at both macro and micro levels in these countries, finally Section 4 concludes.

1. Theoretical and empirical literature on the relationship between ICT and economic growth

Both the rapid development in ICT and the recent trend of globalization and their various influences in different economic systems have been an exciting and interesting recent research issues that received increasing interest amongst economists in both developed and developing countries.

While it is admitted that the impacts of ICT like many other forms of technological progress is difficult to measure, many recent theoretical and empirical literature use several indicators to approximate their effects in economic growth. For instance, some recent studies use an index of investment or expenditures on ICT, IT, computer or computer equipment and provide robust results showing the various influences on economic growth, productivity, employment, work organization and skill upgrading. Several studies in the literature examine the positive impacts of ICT mainly IT on productivity (cf. Hitt and Brynjolfsson, 1996; Brynjolfsson and Yang, 1996), growth and development (cf. Jorgenson and Stiroh, 1995, Phojola; 2000, 2001), work place organization (cf. Bresnahan, Hitt and Brynjolfsson, 1999) and skill upgrading (cf. Hwang, 2000). One interesting finding in the literature emphasis the importance of ICT for enhancing economic growth not only directly, but also indirectly through the

complementary relationships between ICT, human capital/skill and skill upgrading. For instance, several studies use many indicators to examine the complementary relationships between technological progress as measured by ICT and human capital as measured by the increasing utilization of higher educated workers (cf. Goldin and Katz, 1998; Bresnahan et al. 1999; Autor, Katz, and Krueger, 1998 Acemoglu, 1998). In conjunction with these interpretations, some studies explain the relationship between ICT, IT or computer use and skill upgrading defined by the increase either in the incidence of training (cf. Bresnahan, 1999) or the share of high skilled workers (cf. Autor, Katz and Krueger, 1998; Bresnahan, 1999; Hwang, 2000). On the other hand, along with the interpretation of skill– biased nature of technical change, some studies investigate some negative impacts of the increasing use of IT or ICT (cf. Bound and Johnson, 1992; Berman Bound and Griliches, 1994; Freeman and Soete, 1994; Acemoglu, 1998; Autor, Katz, and Krueger, 1998). Moreover, some studies raised the controversy that the increasing use of ICT may have some negative impacts for the developing countries, particularly, because of intensifying competition and creating more comparative advantageous for developed countries and hence widening the already existing gap and digital divide between the developed and developing countries.

In light of the above background and given the relatively few studies (cf. Nour, 2006) that explain only limited aspects of ICT market in the Arab countries, it may be useful in this paper to examine both the use and economic impacts of ICT mainly in the Arab Gulf countries. In this paper we will be focusing only in the Arab Gulf countries that would be more relevant mainly because of the heavy concentration of ICT market in these countries and therefore the corresponding economic impacts is expected to be more important than the other Arab countries. Our study therefore may be interesting to contribute to recent effort aimed at building the information and knowledge society in the region and it will fill important gap in the literature dealing with Arab countries. Our analysis in this paper is important, interesting and differs from earlier studies, since we present a comparative macro-micro analysis to examine ICT market in these countries. In addition, we use the most update and relevant data wherever available.

One limitation of our analysis in this paper is related to the limited scope of our analysis, since we explain only the economic impacts and the use/demand side of ICT market in the Arab countries. While we admit that it is also essential to investigate the supply side of ICT market in these countries, our analysis, will not cover the supply side, mainly due to the scarcity of necessary information. Which may be related to the

somewhat monopolistic structure of the supply side as can be seen from the limited number of Internet services providers (IPS) in most of the Gulf countries (except Saudi Arabia), we leave that for more in-depth analysis in the future. Other limitation of our analysis is related to scarcity of an updated information at the macro level and the limited numbers of observations for some variables used in our analysis at the micro level that constitute some limitations of our regressions results. Apart from these limitations our paper is useful to improve understanding of ICT market and the corresponding economic impacts in the Arab region.

Our paper aims to examine both the use/demand and economic impacts of ICT at both macro-micro levels in the Arab Gulf countries, in particular, our aim is to test the following four stylised facts:

1. At the macro and micro levels, the demand for ICT (measured by the use and spending on ICT) is characterizing by considerable dynamism: shows a dynamic increasing trend over time across countries but a decreasing trend over time across firms.
2. At the macro level the use/demand for ICT shows a normal demand curve decreasing in price and increasing in income (measured by GDP per capita). At the micro level, spending on ICT increases in firm size (capital and labour) and industry level.
3. At the macro level, the use of Internet and mobile shows positive significant correlations (complementary relationships) with the use of telephone. At the micro level, the use of/ total spending on IT (computer) shows positive significant correlations (complementary relationships) with both telecommunication and ICT training.
4. At the macro and micro levels spending on ICT show positive but inconclusive economic impact.

To examine the four stylised facts presented above, we use the descriptive approach and OLS technique. Our analysis at the micro level uses primary data based on the results obtained from the survey of Nour (2002b) that cover the medium and large size firms which are active in the chemical and metal industries in the United Arab Emirates as a case of the Gulf countries. Our analysis at the macro level uses the secondary data presented in Table 1 below.

Table 1- The use and economic impacts of ICT in the Arab Gulf countries (2000–2003)

	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE
Internet [a]	247	106	66	115	62	337
Telephone [a]	263	204	84	289	144	314
Mobile [a]	583	519	171	438	217	696
($ per 20 hours of use) [a]	39	25	24	22	35	13
(% of monthly GNI per capita)[a]	4	2	4	1	5	1
(per three minutes) [a]	2	2	1	2	2	2
GDP PC [a]	15196	14455	11813	19844	11377	22420
GDP PC [b]	17170	16240	13340	19844	12650	22420
GDP [a]	7594046	27000650	15601980	NA	165504500	56380000
GDP [b]	7.7	35.4	20.3	17.5	188.5	71
ICT/GDP [c]	2	2.73	NA	NA	7.6	1.77
School life expectancy [d]	13	8.7	8.7	13.1	9.5	10.7
Mean years of Schooling year [e]	6.1	6.2	0.9	5.8	3.9	5.6

Sources: (a) World Development Indicators database and International Telecommunication Union, (b) UNDP (2004), (c) ESCWA (2003), (d) UNESCO-UIS database (2005), (e) Barro and Lee database (2000), (f) WITSA (2002).

2.1 The status of ICT in the Arab Gulf countries

Earlier studies explained that the Arab countries are still falling far behind the advanced world countries and the international level in terms of both the use and spending on ICT (cf. Nour, 2002a; Nour, 2006). More recent information from the ITU indicates that the growth rate of main telephone lines falls below the world average, however, the growth rate of cellular subscribers increased faster than the world average throughout the period (1996-2003). Within the Arab region, we observe the substantial disparity in terms of ICT diffusion across the Arab high, medium and low income groups. In particular, the Internet users, telephone mainlines and cellular subscribers are mainly concentrated in the Arab high income Gulf countries. For instance, in 2002 the average share of high, medium and low income respectively accounted for 81%, 17% and 2% of total Internet users; 68%, 27% and 5% of total access to telephone mainlines, and 78%, 16% and 6% of total cellular subscribers in the Arab countries. Table 2 below indicates that despite the fact that the population in the Gulf countries accounts only for 11% of total Arab population, due to high GDP per capita they dominate ICT market in the Arab region, the Gulf population accounts for 70%, 55% and 71% of total Arab population using the Internet, telephone and mobile. In this paper, our analysis in the next sections will be focusing only in the Arab Gulf countries, mainly because the anticipated corresponding economic impacts is likely to be more important than the other Arab countries due to the heavy concentration of ICT market in these countries. Table 3 below illustrates that

in terms of both ICT use index and PC purchasing power over the period (2002-2003), the average for the Gulf countries is higher than the average for all Arab countries.[2]

Table 2- Demand for and Supply of ICT: total Population, percentage of total population with access to main Telephone lines, Mobile Cellular, Internet and Internet Services Providers (ISP) in the Arab Gulf Countries (2002)

Country	Total Population (Million) (2002)	GDP/per capita (PPP US $) (2002)	Internet services providers	Population accessing Internet (share in Arab)	Population accessing Telphone (share in Arab)	Population accessing Mobile (share in Arab)
	2002	2002	2002	2002	2002	2002
United Arab Emirates	2.9 (1)	22,420	1	313.2 (24)	291 (12)	647 (18)
Qatar	0.6 (0.2)	19,844	1	113.4 (9)	286 (12)	433 (12)
Kuwait	2.4 (0.8)	16,240	3	105.8 (8)	204 (9)	519 (14)
Bahrain	0.7 (0.2)	17,170	1	245 (19)	261 (11)	579 (16)
Oman	2.8 (0.9)	13,340	NA	70.0 (5)	92 (4)	183 (5)
Saudi Arabia	23.5 (7.9)	12,650	21	64.6 (5)	151 (6)	228 (6)
Average [total] Gulf	[32.9] (11.1)	16,944	[27]	(70)	(55)	(71)
Average [total] Arab states	[296.6]	5,069		28.0	81	85
Norway				502.6	734	844
Sweden				5731	736	889
United States				551.4	646	906
United Kingdoms				423.1	591	814
Korea, South				551.9	489	679
Singapore				504.4	463	796

Source: UNDP (2004) Human Development Report (2004).

Table 3- ICT use index and PC purchasing power in Arab Gulf countries 2002- 2003

	End of 2002 IC use Index	End of 2003 IC use Index	PC units purchasable by GDP per capita
Bahrain	1.15	1.26	11.39
Kuwait	0.95	1.17	15.13
Qatar	0.75	0.92	23.05
Oman	0.35	0.39	6.66
Saudi Arabia	0.50	0.61	7.90
UAE	1.40	1.50	18.19
Average Gulf	0.85	0.975	3.03
Total Arab	0.22	0.27	2.27

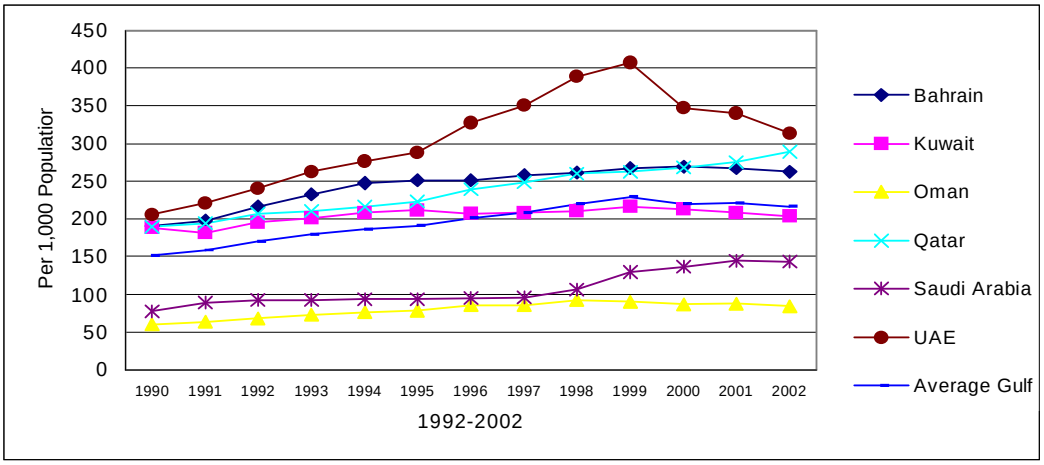
Source: Madar Research Group: www.madarresearch.com

[2] The ICT use index covers four ICT parameters: PC installed base and the number of internet users, mobile phones and fixed lines. The index is calculated by adding up the values of these four parameters and dividing the sum by the country's population figure. A higher index score indicate more aggressive ICT adoption in the country under question. Higher PC purchasing power may reflect more aggressive attitude toward PC purchase.

2.2 The trends and determinants of the use and demand for ICT at the macro-micro levels

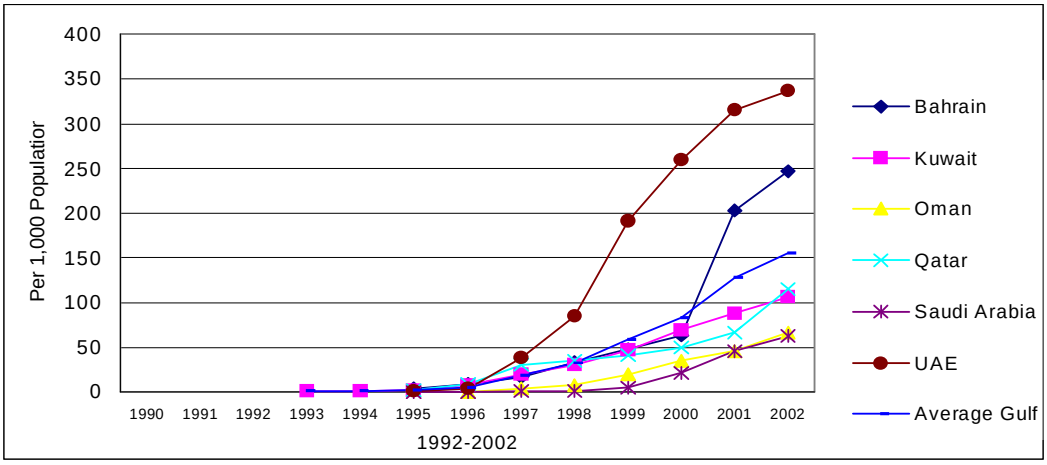
Based on the above backgrounds, in this section it is useful to focus our analysis in the Arab Gulf countries. We first investigate the first stylised fact that at the macro and micro levels, the demand for ICT (measured by the use and spending on ICT) is characterizing by considerable dynamism, i.e. shows a dynamic increasing trend over time across countries but a decreasing trend over time across firms. For instance, Figures 1-3 below corroborate the first stylised fact that the use of telephone, mobile and Internet show a considerable dynamism with increasing trends over time at the macro level across the Gulf countries during the period (1992-2002). In contrast to the macro level, at the micro level Figure 4 below shows a dynamic but a considerable tremendous decreasing trend over time (over the period 1999-2001) in total spending on ICT across firms -except small increase within the metal firms. This micro result can be attributed to a lack of plans for critical expansion on ICT or general contraction in total spending on ICT across firms. During the period (1999-2001) the uses of ICT (61%) increased faster than that of other technologies (56%) across all respondents firms in the firm survey conducted by Nour (2002b)- cf. Figure 5. At the micro level, the heavy concentration and large share in total ICT spending across the chemical and large size compared to metal and medium size firms indicate a considerable disparity in the use of ICT across firms- cf. Figure 6. This result implies considerable disparity across firms in terms of the total spending and the use of ICT according to firm size and industry level (1999-2001), i.e. large size and chemical firms tend to spend more on ICT compared to medium size and metal firms over the period. The share of large size firm exceeds 90%, while the share of medium size firms remain less than 10% of total ICT spending over the period (1999-2001). Similarly, the share of chemical firms wide-ranging between more than 90% to near 60% while the share of metal firms wide-ranging between less than 10% to near 40% of total ICT spending over the period (1999-2001).

Figure 1: Access to main telephone lines in the Gulf countries (Per 1,000 population) (1992–2002)



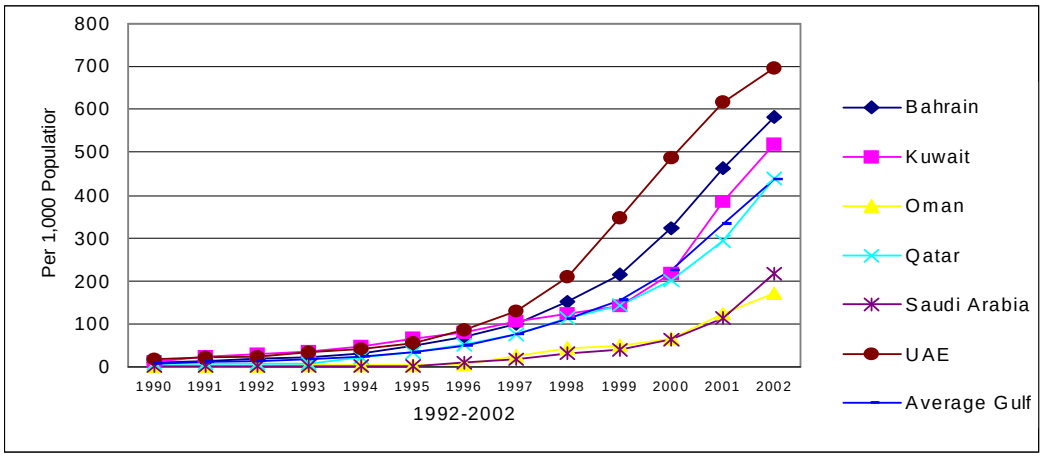
Sources: World Development Indicators database and International Telecommunication Union

Figure 2- The use of Internet in the Gulf countries (Per 1,000 population) (1992–2002)



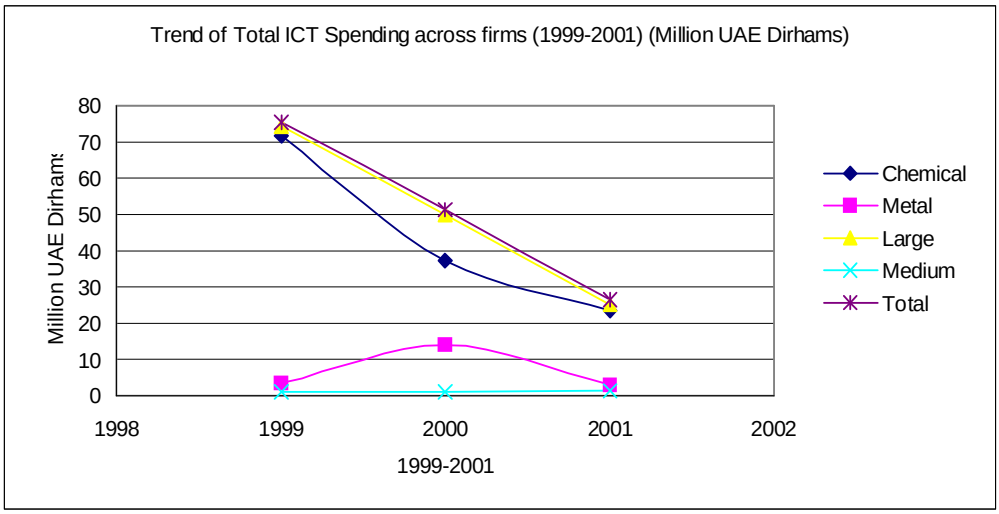
Sources: World Development Indicators database and International Telecommunication Union

Figure 3- The use of mobile cellular telephones in the Gulf countries (Per 1,000 population) (1992–2002)



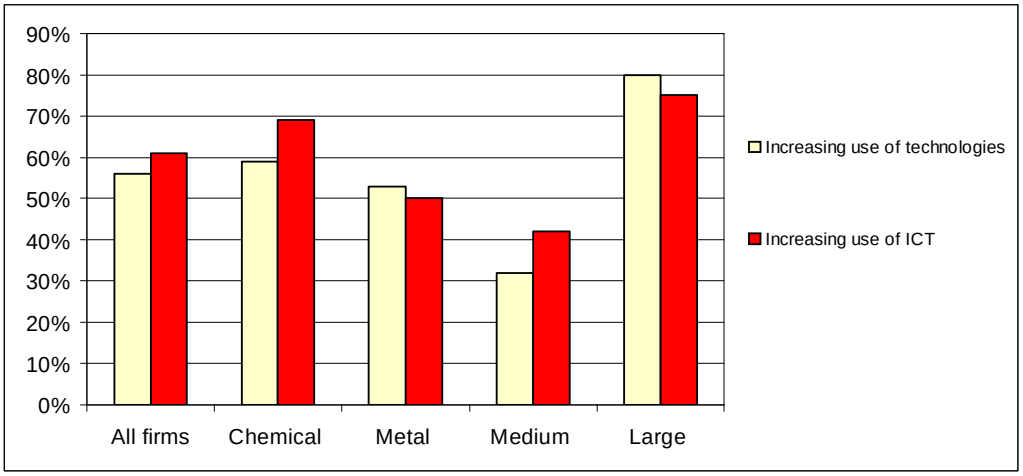
Sources: World Development Indicators database and International Telecommunication Union

Figure 4 –Trend of Total ICT Spending across firms (1999-2001) (Million UAE Dirhams)



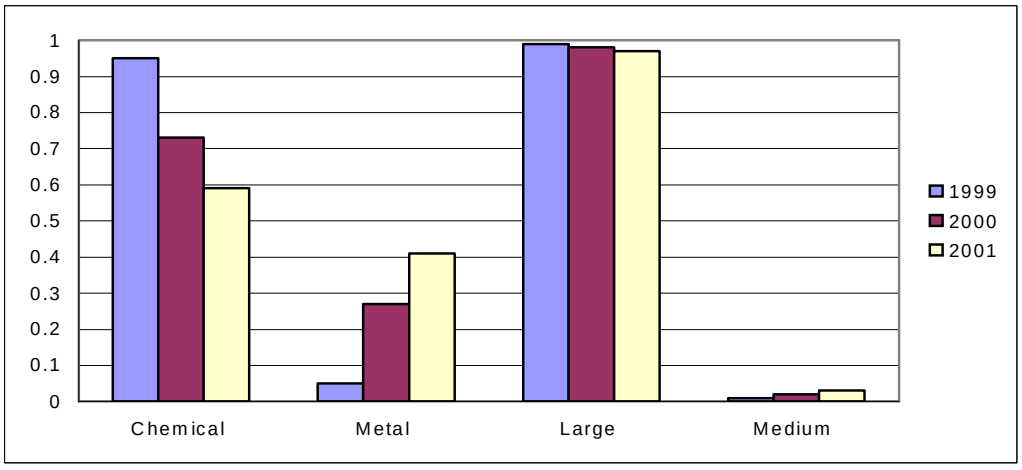
Source: Survey of Nour (2002b)

Figure 5- The increasing use of technology and ICT across firms, 1999-2001



Source: Survey of Nour (2002b)

Figure 6 – The share and trend of total spending on ICT across firms (1999-2001)



Source: Survey of Nour (2002b)

Our results in Tables 4-5 below prove the second stylised fact concerning the determinants of the use/demand for ICT that at the macro level the use of/demand for ICT shows a normal demand curve decreasing in price and increasing in income (measured by GDP per capita). At the micro level, spending on ICT increases in firm size (capital and labour) and industry level. Table 4 illustrates that at the macro level the use of/demand for ICT shows a normal demand curve decreasing in price and increasing in income (measured by GDP per capita). Mainly the use of Internet seems more sensitive and highly correlated with income level but less sensitive and negatively correlated to price at the macro level. Similarly, the use of telephone and mobile are highly sensitive and positively correlated to income (measured by GDP per capita). The correlation with GDP per capita is more significant with respect to telephone and mobile respectively than Internet. This result may imply that consumer's preference – corresponding to purchasing power, income or GDP per capita- seem to be in favor of or more sensitive towards the use of telephone and mobile than the Internet, which may not be surprising in light of a considerable illiterate population, since the use of Internet requires more and specific literacy.[3] So the majority –including illiterate- of consumers/population may prefer to use telephone and mobile than Internet. Somewhat surprising the use of telephone is positively correlated to price. An inverse relationship between the demand and price of telephone may imply that even with the increasing price, the use of telephone will not going to diminish, i.e. telephone service is a necessary service for consumers in these countries. Table 5 below shows that at the micro level, total spending on ICT across firms is determined by/increases in firm size (capital and labour) and industry level- see also Figure 6 above.

Table 4- Determinants of ICT use: demand, price, GDP per capita across the Gulf countries (2002-2003)

across the Gulf countries at the macro level	Coefficient (t-value)					R^2
	Constant	Internet: (Price HRS)	Internet: (Price MTH)	Telephone: (Price MNTS)	GDPPC (UNDP)	R^2
Internet (Gulf)	252.662 (1.614)	-3.690 (0.653)				0.096
Internet (Gulf)	235.247 (2.491)		-28.146 (-0.966)			0.186
Internet (Gulf)	-243.240 (-1.550)				2.593** (2.593)	0.627
Telephone (Gulf)	-74.800 (-0.531)			158.800** (2.110)		0.527
Telephone (Gulf)	-157.437 (-2.033)				0.022** (4.923)	0.858
Mobile (Gulf)	-357.200 (-1.421)				0.047** (3.224)	0.722

**. Correlation is significant at the 0.01 level (1-tailed)

[3] The average illiteracy rate for the Gulf population (15 years and above) is 18.6%- cf. UNDP-HDR (2002)

Table 5– Total spending on ICT, labour and capital across firms (1999-2001)

Independent variables		Labour	Capital	Constant	R^2	N
Dependent variable (ICT expenditures)		*Coefficient (t-value)*	*Coefficient (t-value)*	*Coefficient (t-value)*		
ICT expenditures	Large	1.523** (4.625)		4.008 (2.138)	0.641	14
	Medium	9.418** (3.307)		-29.257 (-2.454)	0.610	9
	Chemical	2.065** (3.361)		1.179 (0.370)	0.485	14
	Metal	1.167** (2.674)		5.655 (2.537)	0.505	9
ICT expenditures (All firms) (log) [1]	1999	0.860** (2.636)	0.241* (1.651)	3.805 (1.805)	0.630	13
	2000	1.068** (2.461)	0.189 (0.978)	3.763 (1.290)	0.517	13
	2001	0.739** (2.243)	0.175 (1.264)	5.491 (2.573)	0.541	12

*. Correlation is significant at the 0.05 level (1-tailed), **. Correlation is significant at the 0.01 level (1-tailed). Note (1) Log value for all estimated variables: ICT, labour and capital.

3. The economic impact of ICT at the macro-micro levels

Considering the above discussion on the use and determinant of ICT, in this section we examine the third and fourth stylised facts on the economic impacts of ICT at the macro-micro levels. Table 6 below substantiates the third stylised fact that at the macro level, the use of Internet and mobile shows positive significant correlations (complementary relationships) with the use of telephone. Our results summarized in Table 7 below corroborate the third stylised fact at the micro/firm level concerning the complementary relationships between the use of/spending on computer, telecommunication and training which can be read as complementarity between technology and upskilling (cf. Colecchia and Papaconstantinou, 1996; Bresnahan and Hitt, 1999). Muysken and Nour (2006) find complementary relationships between skill, technology (ICT) and upskilling (ICT training). For instance, from these results we observe the complementary relationship between the share of high education and the share of expenditure on ICT, which can be seen and understood as complementarity between skill and technology (cf. Goldin and Katz, 1998; Acemoglu, 1998). We find a complementary relationship between the share of high education and the share of expenditure on ICT training, which can be interpreted as complementarity between skill and upskilling. (cf. Muysken and Nour, 2006: p. 969)

Table 6- The complementary relationship between the use of Internet, telephone and mobile at the macro level and the impacts of ICT: ICT/GDP on GDP and schooling across the Gulf countries (2002-2003)

Internet and Telephone	Coefficient (t-value)					R^2
	Constant	Internet	Telephone	Mobile	ICT/GDP	R^2
Internet (Gulf)	-52.036 (-0.564)		0.959** (2.403)			0.591
Telephone (Gulf)	120.590 (2.531)	0.616** (2.403)				0.591
Mobile (Gulf)	-8.978 (-0.073)		2.063** (3.903)			0.792
Telephone Gulf	48.394 (1.033)			0.384** (3.903)		0.792
GDPUNDP (Gulf)	-18.323 (-0.538)				26.659** (3.331)	0.847
GDPPCUNDP (Gulf)	21306.635 (8.200)				-1187.698* (-1.944)	0.654
SCHOOLING2 (Gulf) (excluding SA)	4.869 (5.619)				0.507 (1.290)	0.635

**. Correlation is significant at the 0.01 level (1-tailed)

Table 7- The relationship between Computer, training and Telecommunication expenditure

Independent variables		Computer expenditure	Training expenditure	Telecommunication expenditure	Constant	R^2	N
Dependent variables (All firms)		Coefficient (t-value)	Coefficient (t-value)	Coefficient (t-value)	Coefficient (t-value)		
Computer expenditure: All firms	1999		0.620** (2.489)	0.198 (0.626)	2.484 (1.097)	0.815	10
	2000		0.487 (1.325)	0.431 (1.007)	0.633 (0.220)	0.677	12
	2001		0.847* (1.627)	-0.0564 (-0.125)	2.178 (1.141)	0.670	14
Training expenditure: All firms	1999	0.820** (2.489)		0.343 (0.985)	-2.544 (0.957)	0.830	10
	2000	0.369 (1.325)		0.639* (1.972)	-0.936 (-0.376)	0.755	12
	2001	0.247* (1.627)		0.661** (5.219)	0.546 (0.504)	0.911	14
Telecommunication expenditure: all firms All firms	1999	0.309 (0.626)	0.405 (0.515)		3.720 (1.377)	0.675	10
	2000	0.261 (1.007)	0.512** (1.972)		3.601 (1.934)	0.735	12
	2001	-0.0276 (-0.125)	1.107** (5.219)		-0.127 (-0.090)	0.888	14

*.Correlation is significant at the 0.05 level (1-tailed), **. Correlation is significant at the 0.01 level (1-tailed)

Finally Tables 6-8 prove the fourth stylised fact on the economic impacts at the macro-micro levels. That is at both macro and micro levels spending on ICT show positive but inconclusive economic impact. At the macro level, to examine the economic impacts of ICT spending in the Gulf countries we use the data presented in Table 1 above. Our results are summarized in Table 6 above illustrate that the increase in ICT spending in the Gulf countries is positively and significantly correlated with economic growth -as

measured by GDP- but negatively correlated with GDP Per capita. The total spending on ICT relative to GDP also shows a positive but statistically insignificant correlation with schooling. Therefore, using ICT spending data illustrated in Tables 1 above the regression results in Table 6 above show an inconclusive economic impacts of ICT spending at the macro level in the Gulf countries. We examine the relationship between the total expenditures on ICT, profit and output, Table 8 below illustrates plausible positive[4] significant correlations between total expenditures on ICT and capital and total output (total sales value) and positive insignificant correlations with profit. These results prove the fourth stylised fact concerning the positive correlation between ICT and input-output indicators at the micro/firm level.

Table 8– Total spending on ICT, labour capital, output and profit across firms (1999-2001)

Independent variables		Labour	Capital	ICT spending	Constant	R^2	N
Dependent variables All firms (log)		*Coefficient (t-value)*	*Coefficient (t-value)*	*Coefficient (t-value)*	*Coefficient (t-value)*		
Total output (total sales value)	1999	-45897.058 (-1.606)	1.207** (5.623)	53.858** (11.852)	8423985.9 (2.570)	0.993	12
	2000	-52249.455 (-1.477)	2.120** (7.150)	-1.473 (-1.615)	7906055.0 (1.891)	0.978	12
	2001	-48147.057* (-1.936)	1.808** (8.189)	13.133* (1.922)	10655725 (3.004)	0.984	11
Profit	1999	-1527.002 (-0.130)	0.140 (0.560)	1.988 (0.496)	129363.28 (0.101)	0.730	11
	2000	-5014.495 (-0.641)	0.310* (1.820)	-0.710 (-0.921)	15621.632 (0.012)	0.652	11
	2001	-11348.674 (-1.236)	0.182 (0.608)	1.561 (0.240)	1888472.6 (1.657)	0.515	10

*.Correlation is significant at the 0.05 level (1-tailed), **. Correlation is significant at the 0.01 level (1-tailed)

Our findings concerning the positive significant correlations between ICT and output and insignificant correlation between ICT and profit imply an inconclusive effect at the micro level.[5] The macro observations are consistent with the recent literature indicating the growing but limited effects of ICT diffusion in the developing countries due to a lack of sufficient investment in the complementary infrastructure such as education, skills and technical skills. (cf. Pohjola, 2002; Kenny, 2002). Therefore, these results prove the fourth stylised fact in Section 1 above about the inconclusive effect of ICT at the micro level.

[4] Except in 2000, the correlations between ICT and both output and profit are negative.

[5] At the aggregate level when using the most recent data (2002) on the share of spending on ICT relative to GDP across four Gulf countries: Bahrain, Saudi Arabia, UAE, and Kuwait, we find an inconclusive effect of ICT. Because the share of spending on ICT/GDP shows a significant positive correlation with GDP, but a significant negative correlation with GDP per capita across the four Gulf countries.

4. Conclusions

In this paper we use some primary micro data from the firm survey of Nour (2002b) and some secondary cross countries data to examine four stylised facts on the use and economic impacts of ICT at both macro-micro levels in the Arab Gulf countries. We find that at the macro and micro levels the demand for ICT (measured by the use and spending on ICT) is characterizing by considerable dynamism over time, i.e. shows a dynamic increasing trend across countries, but an opposite decreasing trend across firms. At the macro level the use/demand for ICT shows a normal demand curve decreasing in price and increasing in income (measured by GDP per capita). Our results are consistent with the conventional view on the relationship between demand and income, i.e. a high population access to Internet, telephone and mobile is corresponding to a high GDP per capita. We find that the use of Internet is consistent with the conventional downward sloping demand curve in price, i.e. a fall in the price of Internet service is corresponding to a more population access to Internet. Different from the conventional downward sloping demand curve in price, somewhat surprising the use of telephone show upward sloping demand curve in price, i.e. a rise in the price of telephone service is correlated with a more population use of telephone. At the micro level, total spending on ICT increases in firm size (capital and labour) and industry level. At the macro level, the use of Internet and mobile shows positive significant correlations (complementary relationships) with the use of telephone. At the micro level, the use/total spending on IT (computer) shows positive significant correlations (complementary relationships) with both telecommunication and ICT training. At the micro level, we find positive correlations between the total spending on ICT, output and profit. At the macro level, spending on ICT as percentage to GDP shows a positive significant correlation with GDP- as indicator of economic growth- and a positive insignificant correlation with schooling. Therefore, the total spending on ICT shows positive but somewhat inconclusive economic impacts at both micro and macro levels in the Gulf countries.

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